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Long-Term Restoration of Anterior Shoulder Stability: A Retrospective Analysis of Arthroscopic Bankart Repair Versus Open Latarjet Procedure

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Investigation performed at the Balgrist University Hospital, Zürich, Switzerland

Background: Various operative techniques are used for treating recurrent anterior shoulder instability, and good mid-term results have been reported. The purpose of this study was to compare shoulder stability after treatment with the 2 commonly performed procedures, the arthroscopic Bankart soft-tissue repair and the open coracoid transfer according to Latarjet.

Methods: A comparative, retrospective case-cohort analysis of 360 patients (364 shoulders) who had primary repair for recurrent anterior shoulder instability between 1998 and 2007 was performed. The minimum duration of follow-up was 6 years. Reoperations, overt recurrent instability (defined as recurrent dislocation or subluxation), apprehension, the subjective shoulder value (SSV), sports participation, and overall satisfaction were recorded.

Results: An open Latarjet procedure was performed in 93 shoulders, and an arthroscopic Bankart repair was done in 271 shoulders. Instability or apprehension persisted or recurred after 11% (10) of the 93 Latarjet procedures and after 41.7% (113) of the 271 arthroscopic Bankart procedures. Overt instability recurred after 3% of the Latarjet procedures and after 28.4% (77) of the Bankart procedures. In the Latarjet group, 3.2% of the patients were not satisfied with their result compared with 13.2% in the Bankart group ($p = 0.007$). Kaplan-Meier analysis of survivorship, with apprehension ($p < 0.001$), redislocation ($p = 0.01$), and operative revision ($p < 0.001$) as the end points, documented the substantial superiority of the Latarjet procedure and the decreasing effectiveness of the arthroscopic Bankart repair over time. Twenty percent of the first recurrences after arthroscopic Bankart occurred no earlier than 91 months postoperatively, as opposed to the rare recurrences after osseous reconstruction, which occurred in the early postoperative period, with only rare late failures.

Conclusions: In this retrospective cohort study, the arthroscopic Bankart procedure was inferior to the open Latarjet procedure for repair of recurrent anterior shoulder dislocation. The difference between the 2 procedures with respect to the quality of outcomes significantly increased with follow-up time.

Level of Evidence: Therapeutic Level III. See Instructions for Authors for a complete description of levels of evidence.

Peer review: This article was reviewed by the Editor-in-Chief and one Deputy Editor, and it underwent blinded review by two or more outside experts. It was also reviewed by an expert in methodology and statistics. The Deputy Editor reviewed each revision of the article, and it underwent a final review by the Editor-in-Chief prior to publication. Final corrections and clarifications occurred during one or more exchanges between the author(s) and copyeditors.

Recurrent anterior shoulder instability is a disabling condition that is commonly treated with either an arthroscopic Bankart repair^{1,2} or an open Latarjet³ procedure.

After arthroscopic Bankart repairs, instability recurrence rates have been reported to range from 0% to 37.5%^{4,5}, while recurrence rates after the open Latarjet procedure have been reported to range from 1.7% to 14.2%⁶⁻¹¹, such that the latter is considered to restore stability better than the arthroscopic

Bankart repair¹². Most of these mid-term comparative studies, however, were limited because of a lack of longer-term follow-up.

The aim of the current study was to compare the recurrence rates and timing of recurrence after arthroscopic Bankart repair¹³ and after the open Latarjet procedure¹⁴. Our hypotheses were that the Latarjet procedure restores both shoulder stability and function better than the arthroscopic Bankart repair and that the expected difference in restored stability increases over time.

Disclosure: The authors report no external funding source for this study. The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of this article.

TABLE I Patient Characteristics and Follow-up

	Bankart Group (N = 271)	Latarjet Group (N = 93)	P Value
Age at time of index surgery* (yr)	28.2 ± 11.3	30.8 ± 11.4	0.028
Male patients (%)	67.9	88.2	<0.001
Dominant side involved (%)	57.6	47.3	0.086
Duration of follow-up* (mo)	146 ± 30.6	119 ± 23.2	<0.001

*The values are given as the mean and the standard deviation.

Materials and Methods

With approval of the responsible ethical committee, a retrospective comparative case-cohort analysis was performed for all patients who had undergone a primary arthroscopic Bankart repair or a primary open Latarjet procedure for recurrent anterior glenohumeral joint instability at our institution. A 10-year study period was set from January 1, 1998, to December 31, 2007, ensuring a minimum follow-up of 6 years.

Within the observation period, 815 Bankart and Latarjet procedures were performed at our institution, and 504 of them were first-time procedures for shoulder instability. The exclusion criteria were previous instability surgery, posterior or multidirectional instability, convulsive disorders, or concomitant, massive rotator cuff tears. Seventeen shoulders that met one of these criteria were excluded. Between 1998 and 2001, 70 shoulders with recurrent anterior instabilities associated with glenoid rim lesions were treated with an open procedure other than a Latarjet procedure. Another 12 open Bankart, reverse Bankart, segmental humeral head reconstruction, or labral repair procedures for painful shoulders not associated with recurrent anterior dislocations were excluded. Arthroscopic Bankart repairs were performed only on shoulders with no anterior glenoid rim lesions or on those with anterior glenoid rim lesions involving less than half of the length of the maximum glenoid diameter, which corresponds to a loss of approximately 9% to 10% of the total glenoid surface^{15,16}.

A total of 405 shoulders in 401 patients met the inclusion criteria. A Latarjet procedure was performed on 106 shoulders and an arthroscopic Bankart, on 299 shoulders. Of these, 13 patients (12%) in the Latarjet group and 28 patients (9.4%) in the Bankart group were lost to follow-up. Three of these patients were contacted, but they declined to participate in the study; the others could not be traced. Therefore, a total of 364 shoulders in 360 patients were included in the study, resulting in an overall follow-up rate of 89.9% (93 shoulders in the Latarjet group and 271 in the Bankart group).

The mean age, sex distribution, dominant extremity involvement, and clinical follow-up time are summarized in Table I.

The Latarjet procedure was performed according to the Walch refinement of the original technique described by Latarjet^{3,14,17}. Through a deltopectoral approach, the pectoralis minor tendon was released from the coracoid. The coracoacromial ligament was divided 1 cm lateral to the coracoid. The coracoid was osteotomized at its base, and the posterior surface was cleaned and flattened using an oscillating saw. Two anteroposterior 3.5-mm drill-holes, separated by at least 1.5 cm, were then drilled through the coracoid. The subscapularis muscle was split longitudinally slightly below its mid-level. Following a vertical capsule incision as close to the glenoid rim as possible, a humeral retractor was introduced into the joint. The anteroinferior aspect of the labrum was resected, and the coracoid was positioned flush with the glenoid plane on the anterior aspect of the scapular neck at the 2 to 5 o'clock position in a right shoulder (10 to 7 o'clock in a left shoulder) and was fixed with two 4.5-mm AO malleolar screws (Synthes). The stump of the coracoacromial ligament was sutured to the most medial aspect of the joint capsule. The patients wore a sling for 10 days and were allowed to return to sports at the end of the fourth month.

For the arthroscopic Bankart repair, the patient was placed in the lateral decubitus position with the arm abducted approximately 45° with longitudinal traction of 3 kg. The joint was examined through a posterior viewing portal. The anterior capsulolabral complex was freed from the anterior aspect of the scapular neck to the 6 o'clock position using a sharp, curved rasp until the subscapularis muscle was easily visible. For adequate exposure of the inferior part, the arm was often abducted to approximately 70°. The anterior aspect of the scapular neck was cleaned using a motorized burr. The inferior glenohumeral ligament was then reinserted using 3 (or 4) anchors positioned at the edge between the glenoid surface and the scapular neck at the 5, 4, and 2 o'clock positions. For the reinsertion, the capsule was shifted from inferior to superior, and for very inferior detachments, the most inferior stitch was performed through the posterior portal to gain more inferior access. Nonabsorbable number-2 sutures and nonabsorbable anchors were used. The patients wore a sling for 4 weeks, and participation in sports was not allowed for 6 months.

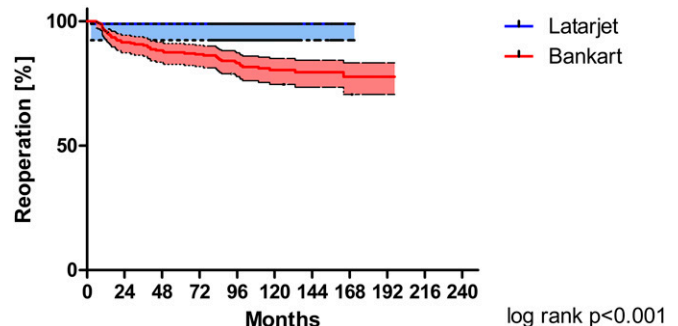
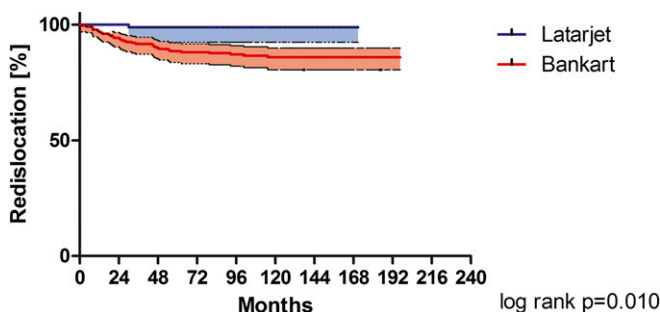


Fig. 1

Fig. 2

Fig. 1 Kaplan-Meier survivorship analysis, with redislocation as the end point, for the Bankart and Latarjet groups over time, with the shaded area indicating the 95% confidence interval (p = 0.01). **Fig. 2** Kaplan-Meier survivorship analysis, with surgical revision as the end point, for the Bankart and Latarjet groups over time, with the shaded area indicating the 95% confidence interval (p < 0.001).

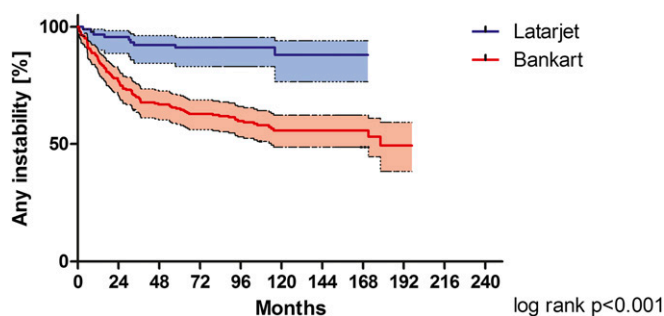


Fig. 3
Kaplan-Meier survivorship analysis, with recurrence or persistence of apprehension or overt instability as the end point, for the Bankart and Latarjet groups over time, with the shaded area indicating the 95% confidence interval ($p < 0.001$).

The majority of the procedures were performed by the senior author (C.G.), with the remaining procedures performed by 2 fellowship-trained shoulder surgeons experienced in both techniques.

The choice of the procedure was at the discretion of the surgeon if there was no osseous lesion of the anterior glenoid rim that was longer than 50% of the maximum anteroposterior glenoid diameter measured on routinely performed preoperative computed tomography (CT) arthrograms¹⁶. If the osseous lesion was $>50\%$, a Latarjet procedure was performed, as it is known that larger glenoid rim lesions are associated with a high recurrence rate after arthroscopic Bankart procedures^{18,19}.

Clinical outcome parameters, including evidence of recurrent instability (anterior apprehension or recurrent overt instability [subluxation and redislocation]), revision for recurrent instability, the mean time to recurrence, incapacity for work, and sports participation, were recorded. *Anterior apprehension* was defined as the subjective sensation of fear of the shoulder dislocating with the arm positioned in abduction and external rotation. *Subluxation* was defined as the subjective sensation of glenohumeral slipping or shifting followed by either spontaneous reduction or manual resetting of the joint by the patient²⁰. *Redislocation* was defined as any documented dislocation requiring reduction by a third party or medical professional. All types of recurrences were recorded separately, with the first time of occurrence of a type of instability as the first metric and the first time of recurrence as the second key metric. If a patient had a first-time recurrence of sublux-

ation at 1 year and a redislocation at 2 years, he or she was listed as having subluxation and dislocation; if a patient had a recurrent dislocation without subluxation or apprehension, he or she was listed as having redislocation only. The time to recurrence was recorded until 80% and 95% of the first recurrences after the index repair had occurred.

All patients were contacted, and the information for the study was obtained from a detailed follow-up questionnaire that was completed and returned by 92 patients and from a telephone interview, which used the same questionnaire and was completed by 272 patients.

Overall patient satisfaction was graded as excellent, good, fair, and poor. In addition, preoperative and postoperative subjective shoulder values (SSVs) were compared²¹.

Statistical analysis was performed using Prism 5.0 software (GraphPad) and SPSS (version 22.0; IBM). Data were tested for normal distribution with the Kolmogorov-Smirnov test before using the Student *t* test for parametric data or the Mann-Whitney *U* test for nonparametric data. The chi-square test was used to assess differences between categorical data. The level of significance was set at a *p* value of <0.05 .

Results

At a mean follow-up of slightly over 10 years, redislocation had occurred in 13% (36) of the 271 shoulders with a Bankart repair and in 1% (1) of the 93 shoulders with a Latarjet repair ($p = 0.0002$). Subluxation had occurred after 19% (51) of the Bankart repairs and after 2% (2) of the Latarjet repairs ($p = 0.0001$), and apprehension was reported for 29% (78) of the 267 patients (271 shoulders) in the Bankart group and for 9% (8) of the 93 patients in the Latarjet group ($p < 0.001$). Any type of subjective instability (apprehension, subluxation, and/or dislocation) was present (persistent or recurrent) in 41.7% (113) of all 271 shoulders in the Bankart repair group and in 11% (10) of all 93 shoulders in the Latarjet group ($p = 0.0001$). At the final follow-up, the cumulative revision rate for recurrent instability was 21% (57 shoulders) in the Bankart group and 1% (1 shoulder) in the Latarjet group ($p = 0.0001$).

The mean time to recurrence of instability is summarized in Table II. The time to recurrence was very different for the 2 groups. After 2 years, 61% (22) of the 36 future first-time

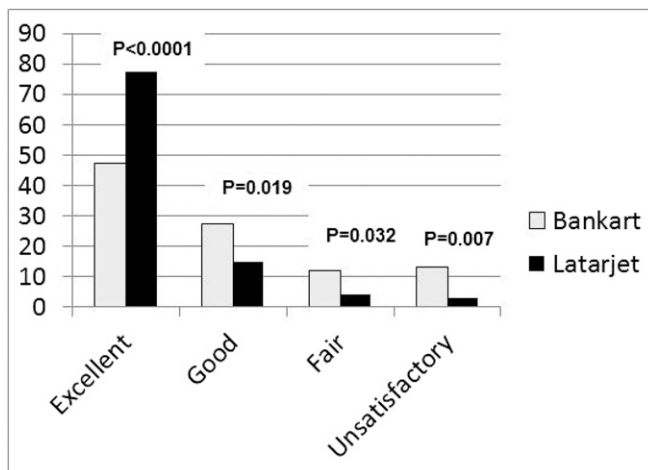


Fig. 4

Fig. 4 Patient satisfaction percentage. **Fig. 5** Percentage of patients who returned to sports ($p = 0.045$), had a permanent incapacity for work ($p = 0.098$), and/or received a disability pension ($p = 0.205$).

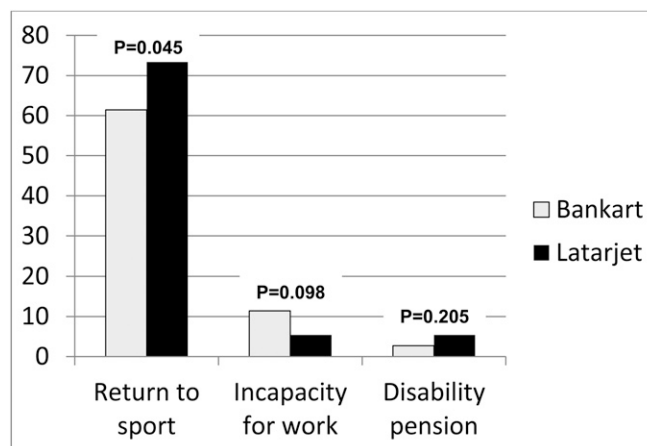


Fig. 5

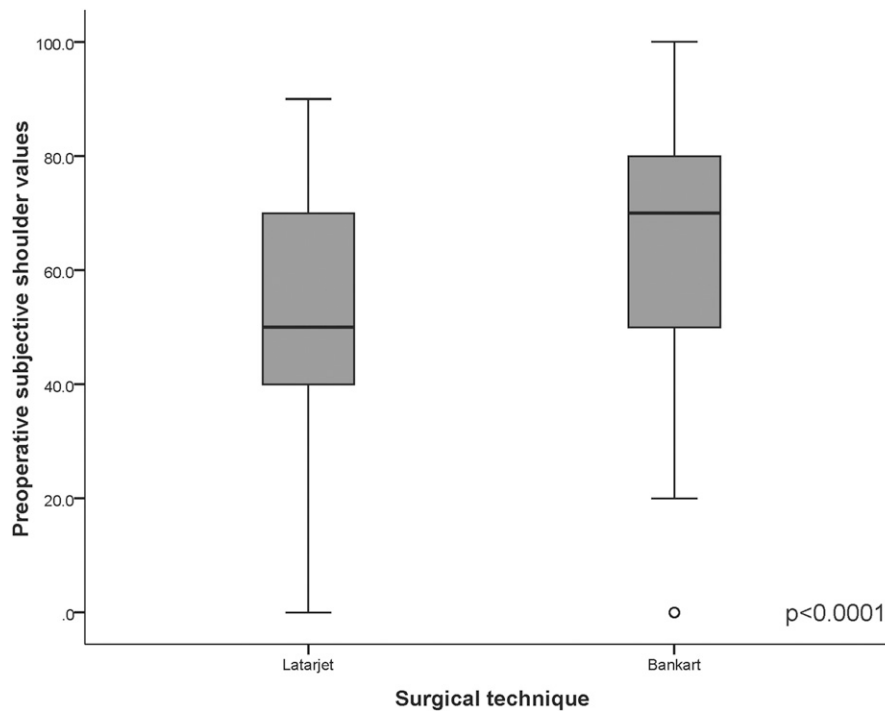


Fig. 6

The mean preoperative SSV (and standard deviation) was 63 ± 21.23 for the Bankart group and 50.92 ± 21.23 for the Latarjet group; the difference was significant ($p < 0.0001$). The top and bottom of the box represent the 25th and 75th percentiles, the horizontal line inside the box represents the median, the whiskers are the 10th and 90th percentiles, and the circle represents an outlier.

redislocations had not yet occurred in the Bankart group. This rate declined, and 5 years after the index operation, 17% (6) of the 36 observed first-time redislocations had not yet occurred.

In the Latarjet group, there was only 1 redislocation at 29 months postoperatively (Fig. 1). It was reduced and no further treatment was needed. In the Bankart group, 20% (15) of

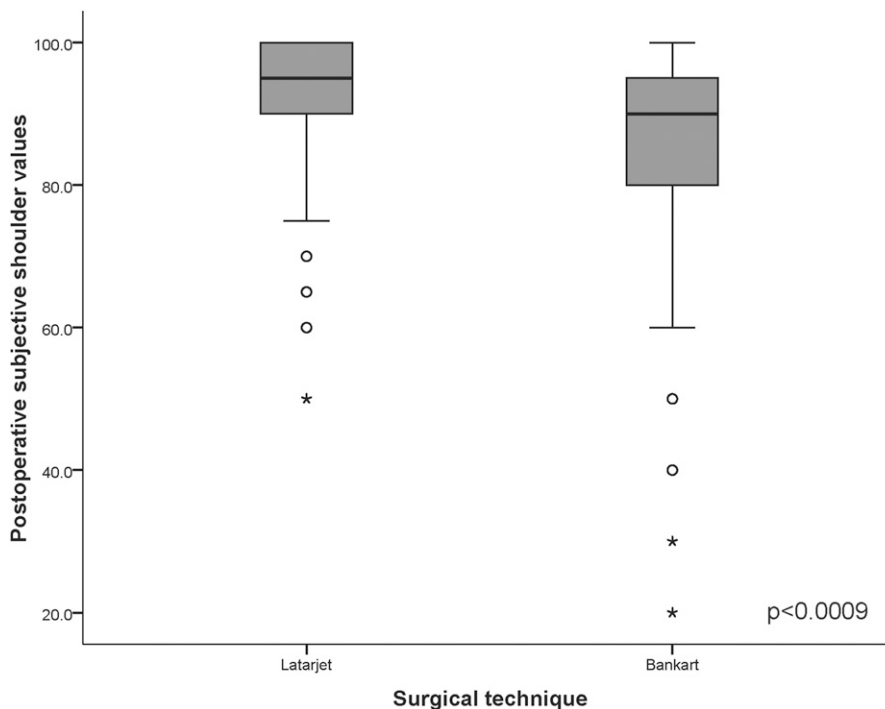


Fig. 7

The mean postoperative SSV (and standard deviation) was 82.04 ± 17.02 for the Bankart group and 88.77 ± 14.63 for the Latarjet group; the difference was significant ($p < 0.0009$). The top and bottom of the box represent the 25th and 75th percentiles, the horizontal line inside the box represents the median, the whiskers are the 10th and 90th percentiles, and the circles represent outliers. The asterisks indicate extreme outliers.

TABLE II Time to Recurrence or Revision

	Time to Recurrence* (mo)		P Value
	Bankart Group (N = 271)	Latarjet Group (N = 93)	
Any instability	32.7 ± 36.0	30.2 ± 34.23	0.934
Subluxation	45 ± 44.7	65 ± 70.0	0.427
Redislocation	34.8 ± 27.9	29.7†	0.882
Revision	94.2 ± 42.4	2.53†	0.106

*The values are given as the mean and the standard deviation. †No standard deviation was possible in the Latarjet group because only 1 patient had redislocation and revision.

the 77 ultimate first-time recurrences had not yet occurred at 91 months postoperatively and 5% (4) had not yet occurred at 119 months postoperatively.

In the Latarjet group, all 3 recorded recurrences had occurred 2 years postoperatively. One operative revision for recurrent instability as well as 4 additional revisions for other reasons than recurrent instability were necessary in the Latarjet group. One patient had a postoperative hematoma that required evacuation, 1 patient desired hardware removal, and 1 patient had the screws replaced because they were too long and irritated the infraspinatus. Finally, 1 patient required secondary shoulder arthroscopy with repair of a SLAP (superior labral anterior-posterior) tear within the observation period.

Thereafter, all but 1 of these patients had an uneventful postoperative course.

In the arthroscopic Bankart group, revision surgery because of recurrent instability became necessary up to >15 years postoperatively. Of these revisions, one-third had not been performed at the time of the 5-year follow-up (Fig. 2). Two patients in the Bankart group underwent revision surgery for reasons other than recurrent instability. One patient reported shoulder pain following a sports accident 6 months after the initial surgery. Radiographic workup revealed a displaced anchor, which was removed. In another patient, a diagnostic shoulder arthroscopy and an acromioplasty were performed because of persistent pain 2 years after surgery.

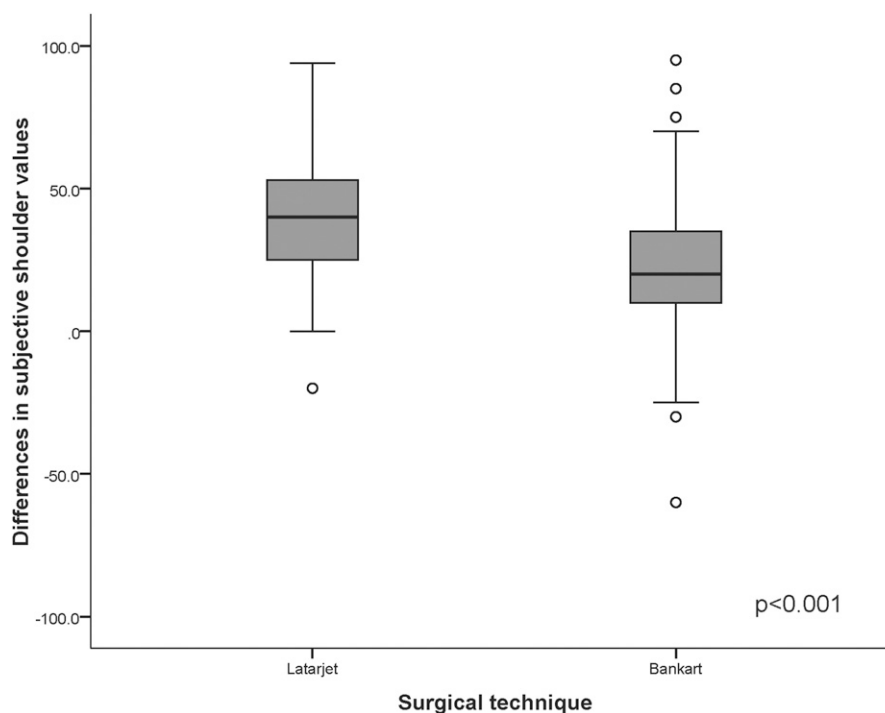


Fig. 8

The mean difference in the preoperative and postoperative SSVs was 18.91 ± 23.14 for the Bankart group and 37.95 ± 23.84 for the Latarjet group; the difference was significant ($p < 0.001$). The top and bottom of the box represent the 25th and 75th percentiles, the horizontal line inside the box represents the median, the whiskers are the 10th and 90th percentiles, and the circles represent outliers.

TABLE III Sex as a Risk Factor for Recurrence After an Arthroscopic Bankart Repair

	Male (N = 184)	Female (N = 87)	P Value
Any instability	40% (73)	46% (40)	0.301
Reoperation	21% (39)	21% (18)	0.869
Redislocation	16% (29)	8% (7)	0.013

In accordance with redislocation and revision rates, a similar pattern with decreasing effectiveness of the Bankart repair over time was also documented for apprehension or overt instability (Fig. 3).

The relationship between sex and recurrence rates could not be analyzed in the Latarjet group because of the small number of recurrences. In the Bankart group, redislocation occurred approximately twice as frequently in men as in women ($p = 0.013$) (Table III). There was, however, no significant difference between the rate of operative revisions or overall recurrence of instability between men and women.

The majority of all patients reported at least a fair postoperative result. However, there was a significantly higher percentage of dissatisfied patients in the Bankart group (13.2% versus 3.2%; $p = 0.007$). Furthermore, a higher percentage of highly satisfied patients was found in the Latarjet group (77.4% versus 47.5%; $p < 0.0001$) (Fig. 4).

Most patients were able to return to their previous sports activity, but the percentage of patients returning to their original sport was higher in the Latarjet group ($p = 0.045$) (Fig. 5).

While the mean SSV improved significantly in both groups ($p < 0.001$), the mean postoperative SSV was slightly higher in the Latarjet group (89% versus 82%; $p < 0.0009$). As the mean preoperative SSV in the Latarjet group was significantly lower ($p < 0.0001$), the overall SSV improvement was significantly larger in the Latarjet group ($p < 0.001$) (Figs. 6, 7, and 8). Additionally, the patients in the Latarjet group who did not report instability also had a significantly higher mean SSV (91%) compared with the Bankart patients who were free of residual instability (87%) ($p = 0.002$).

The number of patients with a permanent incapacity for work or who were receiving workers' compensation payments was negligible in both groups.

Discussion

In this retrospective study, the outcome of the open Latarjet procedure was substantially superior to that of the arthroscopic Bankart procedure in essentially all parameters studied. It restored stability, patient satisfaction, and SSV significantly better than the arthroscopic Bankart procedure. There were few early and almost no late failures after the open Latarjet procedure, in contrast to the arthroscopic Bankart repair, which was associated with an increasing and substantial failure rate over time.

Previous studies have documented lower rates of recurrent instability following open Latarjet procedures than

after open^{18,22} and arthroscopic Bankart (soft-tissue) repairs^{12,23}. To our knowledge, this study represents the largest comparative analysis of patient perception of the 2 most common procedures currently used for anterior shoulder instability with a minimum follow-up period of 6 years. We found a subjectively and/or objectively imperfect restoration of stability after 41.7% (113) of the 271 arthroscopic Bankart repairs and after 11% (10) of the 93 open Latarjet procedures, which is higher than in the existing literature^{12,22,23}. This may be the result of longer follow-up, as many other studies likely underestimate recurrent instability because of the standard minimum follow-up of 2 years, which seems inadequate for this pathology. At the 2-year follow-up in our study, the redislocation rates were 5.1% for the Bankart group and 0% for the Latarjet group. The revision rate at the 2-year follow-up was 9.6% for the Bankart and 1% for the Latarjet repairs. In agreement with the findings of Bessière et al.²³, more than half of the recurrent instabilities (61%) in our study occurred later than 2 years postoperatively and continued to occur progressively at lower rates thereafter. The contention that arthroscopic Bankart reconstructions fail progressively^{5,12,24} is therefore confirmed by our study, and the observation that restoration of stability with the Latarjet procedure is stable over time is supported^{6,8,22}.

The higher rate of recurrent instability in our study might also be the result of the definition of recurrent instability. Previous studies often defined recurrent instability as redislocation alone or as redislocation and subluxation. When considering only redislocation and subluxation, we found an overall recurrence rate of 3% for the Latarjet group and 28.4% for the Bankart group. For redislocation alone, the recurrence rates were 1% and 13%, respectively, which are largely comparable with other studies in the literature.

For detailed interpretation of the restored stability, apprehension was assessed as precisely as possible. Apprehension alone may lead to substantial restriction of everyday life as well as negatively affect overall outcome and specifically sports performance. This was confirmed as 7 (1 in the Latarjet group and 6 in the Bankart group) of the 58 surgical revisions were performed for persistent apprehension without recurrent subluxation or redislocation. The transition from apprehension to subluxation may not always be perfectly clear. With the definitions outlined in the Materials and Methods section, patients appeared to be able to determine to which group they belonged or to determine that one form of instability had developed after the other.

The preoperative SSV was lower for the Latarjet patients, suggesting that the preoperative disability was greater in the Latarjet group than in the Bankart group. At the time of final follow-up, however, the mean SSV was significantly higher in the Latarjet group (89% versus 82%; $p < 0.0009$). Therefore, the subjective benefit of shoulder stabilization was significantly greater for the patients in the Latarjet group. We had expected that the more anatomical Bankart procedure would lead to higher subjective satisfaction in the subgroup of patients who did not have recurrent instability. Instead, we found that the

Latarjet subgroup with no such instability symptoms fared significantly better ($p = 0.002$).

There are limitations to this study. First and foremost, this investigation was neither a randomized trial nor a controlled cohort study and therefore has an acknowledged selection bias. Shoulders with relevant glenoid rim lesions, involving >10% of the glenoid surface, are at high risk for recurrence after an arthroscopic Bankart repair^{18,19}. Those shoulders, therefore, were not considered for arthroscopic Bankart repair. This led to a proportionally smaller group of patients without rim lesions in the Latarjet group. There is no suggestion in the literature that patients who have recurrent dislocation with an intact anterior glenoid rim are poor candidates for the Latarjet procedure. The possibility that the absence of glenoid rim lesions deselects less well-suited patients with recurrent dislocation for a Latarjet operation cannot be excluded; however, neither the results seen in our patients nor those in the literature support this hypothesis. Therefore, we assume that the patients in the Latarjet group were at greater risk for recurrence^{19,25-27}. For clinical practice, we believed that it would be unethical to subject the patients with anterior glenoid rim lesions, who are known to have a high risk of recurrence after an arthroscopic Bankart repair and a better prognosis with a Latarjet procedure¹⁹, to a randomized trial. It appeared justified, however, to compare patients who were considered to be good candidates for an arthroscopic Bankart with patients treated with a Latarjet procedure. The results of this study, however, document a clear superiority of the Latarjet procedure, even when excluding the majority of the poor-risk patients from the Bankart group.

Furthermore, the study may be criticized because it was based on patient-reported outcome only. Although additional physical examination might have been interesting, the results of the interviews and questionnaires were found to be appropriate for answering the study questions. Because of the lack of consistent radiographic follow-up, we were not able to evaluate the development or progression of osteoarthritis. Other long-term studies, however, have not shown an increased rate of

arthritic changes following Latarjet procedures compared with soft-tissue reconstructions^{22,24,28}. The SSV, which is known to be influenced by pain, was higher in the Latarjet group than in the Bankart group at the time of final follow-up. Thus, although a difference in the development of asymptomatic osteoarthritis was not formally excluded, we think that it is an unlikely element to influence the interpretation of our data.

Last, the follow-up rate of 90% is possibly less than desired, but is satisfactory with a minimum follow-up of 6 years and a maximum follow-up of 16 years. This follow-up rate compares favorably with studies involving young, mobile patients with similar follow-up periods²³.

In conclusion, the arthroscopic Bankart repair for the treatment of recurrent anterior glenohumeral joint instability is inferior to an open Latarjet procedure in our hands. It does not restore stability, patient satisfaction, or the SSV to the same level as that after an open Latarjet procedure. Failures following the osseous reconstruction procedure are rare and typically occur early in the postoperative course. The effectiveness of an arthroscopic Bankart repair decreases over the postoperative course and leads to a substantial number of late failures, with approximately 1 out of 5 first-time recurrences of instability occurring no earlier than 5 years postoperatively. Therefore, we do not recommend an arthroscopic Bankart procedure to our patients who have recurrent anterior dislocation. ■

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